INSECTS VISITING FLOWERS OF WILD RED RASPBERRY IN SPRUCE-FIR FORESTED AREAS OF EASTERN MAINE[1]

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ABSTRACT: Flower-visiting insects were collected from wild red raspberry (*Rubus idaeus* L.) flowers in spruce-fir forested areas of eastern Maine in 1981. Collections included 5 insect orders and 49 families. At least 38 species of Syrphidae, including 2 new species, and 47 species of Apoidea were represented. The most commonly collected visitors were *Dialictus* spp. bees and Syrphidae. Native Apoidea are probably the primary pollinators of *R. idaeus* in Maine, though some of the more pubescent Coleoptera and Diptera, particularly the syrphids probably have a pollinating function.

Red raspberry, *Rubus idaeus* L.[3], is a common shrub in Maine, growing in a variety of well-exposed situations. It is especially common in cuttings or natural openings in forested areas. It produces biennial canes that reach 2 m in height, from a perennial rootstock (Fernald 1950); only the second year canes produce flowers. Raspberry flowers are borne singly or in small clusters on the terminal portions of the floricane. The flowers are about 1 cm in diameter, with numerous stamens and pistils, creamy-white petals, and conspicuous bristly sepals. The fleshy fruit is typically red in color.

Although the reproductive methods of the genus *Rubus* are not fully understood, it appears that raspberry flowers are largely self-sterile, and insect pollination is necessary for normal fruit development (Jensen and Hall 1979, McGregor 1976). Honeybees are the dominant pollinators of raspberries in agricultural situations (McGregor 1976) and because of the copious production of nectar and pollen, raspberry bloom is considered to be prime bee forage (Howes 1946). Besides the economic value of commercial raspberries in fruit and honey production, wild raspberries, such as *R. idaeus,* provide important wildlife food (Gill and Healy 1974).

Honeybees, *Apis mellifera* L., are rare or absent throughout Maine's spruce-fir forest, so other insects are necessary for pollination and fruit set of wild raspberry. Raspberry flowers are accessible to many types of insect visitors (Faegri and van der Pijl 1971), and this factor, coupled with the high level of nectar and pollen production and wide distribution of *R. idaeus,* should ensure that a varied insect fauna visits the bloom.

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[3]Several varieties of *R. idaeus* L. can be found in Miane; var. *strigosus* (Michx.) Maxim. is probably the variety encountered in this study (Fay Hyland, pers. comm., Fernald 1950).

This work is part of a larger study to determine the effects of spraying with Sevin-4-oil® on insect pollinators and fruit set in a spruce-fir forest (Hansen *et al.* 1982). The objectives of this portion of the study were to document the insect fauna that visits wild red raspberry flowers and to identify the most important species of pollinators. The species of important pollinators could then be compared with those collected in sprayed and unsprayed areas, by use of Malaise traps or by some other method, prior to and following spraying. Assuming that the effect of the spray on insect pollinators was sufficiently great, this type of information may provide evidence that would directly associate lower fruit set with mortality of specific insect pollinator species or groups. Information on other insect visitors would also suggest additional insect species or groups that could be studied in future work on the relationship between insecticide use and fruit set of *R. idaeus.*

MATERIALS AND METHODS

Large stands of flowering *Rubus idaeus* were selected for study throughout Township 36 M.D., Washington Co., Maine. Insects observed visiting flowers were collected with a sweep net or aspirator. Small insects were collected by placing flowers in a killing jar. Collections were made on sunny days from June 4 to June 26, the peak 1981 bloom period. Insects were collected for 1 to 2 hours in the morning and again in the afternoon.

R. idaeus stands were situated along roadsides and in forest openings. The forest overstory was predominantly red spruce, *Picea rubens* Sarg. and balsam fir, *Abies balsamea* (L.) Mill.; other softwood and various hardwood species occurred infrequently. Understory vegetation was sparse under the dense coniferous overstory and consisted primarily of blueberry, *Vaccinium* spp., bunchberry, *Cornus canadensis* L., wild lily-of-the-valley, *Maianthemum canadense* Desf., and several ferns and mosses.

Collected insects, except the Macrolepidoptera, were pinned for identification. Some specimens of Syrphiae are at the U.S. National Museum. All other specimens have been deposited in the collection of the Department of Entomology, University of Maine at Orono.

RESULTS AND DISCUSSION

Five orders and 49 families were represented in the collections. At least 38 species of Syrphidae, including two new species, and 47 species of Apoidea were collected.

Though the study was not designed to give quantitative results, the most numerous *R. idaeus* flower visitors were *Dialictus* spp. (Halictidae) and the various species of Syrphidae. Other common groups were the Cerambycidae,

INSECTS COLLECTED ON FLOWERS OF *RUBUS IDAEUS* L. IN A SPRUCE-FIR FOREST, WASHINGTON CO., MAINE

Hemiptera (nymphs)
- Miridae
- Pentatomidae

Coleoptera
- Scarabaeidae
  - *Trichiotinus affinis* (Gory and Percheron)
- Byrrhidae
- Ptilodactylidae
- Elateridae
- Lampyridae
  - *Photuris pennsylvanica* (De Geer)
- Cantharidae
- Anobiidae
- Byturidae
  - *Byturus rubi* Barber
- Lagriidae
- Mordellidae
- Cerambycidae
  - *Anastranglia sanguinea* (Le Conte)
  - *Clytus ruricola* (Olivier)
  - *Cosmosalia chrysocoma* (Kirby)
  - *Evodinus monticola monticola* (Randall)
  - *Judolia montivagans montivagans* (Couper)
  - *Neoalosterna capitata* (Newman)
  - *Pidonia ruficollis* (Say)
  - *Strangalepta abbreviata* (Swederus)
- Curculionidae

Lepidoptera
- Microlepidoptera
- Macrolepidoptera
- Lycaenidae
- Papilionidae
  - *Papilio glaucus* L.
- Nymphalidae
  - *Nyphalis antiopa* (L.)
  - *Vanessa atalanta* (L.)

Diptera
- Tipulidae
- Chironomidae
- Simuliidae
- Asilidae
- Bombyliidae
  - *Hemipenthes* sp.
  - *Lepidophora* sp.
- Empididae
- Dolichopodidae
- Syrphidae
  - *Blera confusa* Johnson
  - *Carposcalis obscurum* (Say)
  - *Cartosyrphus pallipes* Leow
  - *Cartosyrphus* n. sp.
  - *Chalcosyrphus libo* (Walker)
  - *Chrysotoxum fasciolatum* (De Geer)
  - *Eristalis obscurus* Leow
  - *Epistrophe emarginata* (Say)
  - *E. xanthostoma* (Williston)
  - *Heringia (Neocnemdon) coxalis* (Curran)
  - *Heringia* sp.
  - *Leucozna lucorum* (L.)
  - *Mallota posticata* (Fabricius)
  - *Melangyna lasiophthalma* (Zetterstedt)
  - *Metasyrphus perplexus* Osborn
  - *Microdon tristis* (Leow)
  - *Orthonevra pulchella* (Williston)
  - *Parasyrphus genualis* (Williston)
  - *P. semiinterruptus* (Fluke)
  - *Parasyrphus* n.sp.
  - *Sericomyia chrysotoxoides* Macquart
  - *S. lata* (Coquillett)
  - *S. militaris* (Walker)
  - *Sphaerophoria contingua* (Macquart)
  - *S. longipilosa* Knutson
  - *S. novaengliae* Johnson
  - *Sphegina rufiventris* Leow
  - *Syritta pipiens* (L.)
  - *Syrphus rectus* Osten Sacken
  - *S. ribesii* (L.)
  - *S. torvus* Osten Sacken
  - *Temnostoma alternans* Leow
  - *T. barberi* Curran
  - *T. vespiforme* (L.)
  - *Taxomerus geminatus* (Say)
  - *T. marginatus* (Say)
  - *Volucella bombylans* (L.)
  - *Xylota annulifera* Bigot
  - *X. quadrimaculata* Leow

- Conopidae
- Lauxaniidae
- Anthomyiidae
- Muscidae
- Calliphoridae
- Sarcophagidae
- Tachinidae

Hymenoptera

- Tenthredinidae
- Braconidae
- Ichneumonidae
- Pteromalidae
- Chalcididae
- Gasteruptiidae
  - *Gasteruption kirbii kirbii* (Westbrook)
- Chrysididae
- Formicidae (workers)
- Vespidae
  - *Dolichovespula arenaria* (Fabricius)
- Eumenidae
  - *Ancistrocerus* sp.
  - *Eumenes crucifer* Provancher
  - *Euodynerus* sp.
  - *Stenodynerus* sp.
  - *Symmorphus* sp.
- Pompilidae
- Sphecidae
  - *Ammophila azteca* Cameron
  - *A. evansi* Menke
  - *A. mediata* Cresson
  - *Crossocerus* sp.
  - *Ectemnius arcuatus* (Say)
  - *Ectemnius atriceps* (Cresson)
  - *E. borealis* (Zetterstedt)
  - *E. continuus* (Fabricius)
  - *E. dives* (Lepeletier & Brulle)
  - *E. lapidarius* (Panzer)
  - *E. ruficornis* (Zetterstedt)
  - *E. stirpicola* (Packard)
  - *Lestica* sp.
- Apoidea
- Colletidae
  - *Hylaeus basalis* (Smith)
  - *H. ellipticus* (Kirby)
  - *H. modestus modestus* Say
  - *H. verticallis* (Cresson)
- Halictidae
  - *Augochlora pura pura* (Say)
  - *Augochlorella striata* (Provancher)
  - *Dialictus cressonii* (Robertson)
  - *D. disabanci* Knerer & Atwood
  - *D. laevissimus* (Smith)
  - *D. versans* (Lovell)
  - *D. viridatus* (Lovell)
  - *Dialictus* spp.
  - *Evylaeus divergens* (Lovell)
  - *E. foxii* (Robertson)
  - *E. quebecensis* (Crawford)
  - *E. rufitarsis* (Zetterstedt)
  - *Halictus confusus confusus* Smith
  - *Lasioglossum athabascense* (Sandhouse)
  - *L. coriaceum* (Smith)
  - *L. forbesii* (Robertson)
- Andrenidae
  - *Andrena cressonii* Robertson
  - *A. dunningi Cockerell*
  - *A. lata* Viereck
  - *A. miranda* Smith
  - *A. nasonii* Robertson
  - *A. nigrihirta* (Ashmead)
  - *A. regularis* Malloch
  - *A. thaspii* Graenicher
  - *A. vicina* Smith
  - *A. wheeleri* Graenicher
- Megachilidae
  - *Hoplitis albifrons* (Kirby)
  - *H. cylindrica* (Cresson)
  - *H. producta producta* (Cresson)
  - *Megachle frigida frigida* Smith
  - *M. melanophoea melanophoea* Smith
  - *M. mendica mendica* Cresson
  - *M. mucida* Cresson
  - *M. relativa* Cresson
  - *Osmia albiventris* Cresson
  - *Osmia atriventris* Cresson
  - *O. bucephala bucephala* Cresson
  - *O. proxima* Cresson
  - *O. tersula* Cockerell
- Anthophoridae
  - *Ceratina calcarata* Robertson
  - *Ceratina* spp.
  - *Nomada cressonii cressonii* Robertson
  - *N. depressa* Cresson
  - *N. pygmaea* Cresson
  - *N. sayi* Robertson
- Apidae
  - *Apis mellifera* L.
  - *Bombus ternarius* Say
  - *B. terricola terricola* Kirby
  - *B. vagans vagans* Smith

Scarabaeidae, represented by one species, *Trichiotinus affinis* (Gory and Percheron), Empididae, Sphecidae, Colletidae, and Andrenidae. The frequently collected adults of *Byturus rubi* Barber (Byturidae) fed on *R. idaeus* flowers and flower buds; these insects can cause enough floral damage to affect raspberry yield (Slate *et al.* 1947).

Many insect groups collected on *R. idaeus* flowers are potential pollinators. The various species of native Apoidea are probably responsible for much of the *R. idaeus* pollination in Maine because of their behavioral and morphological adaptations for pollen transport. The stigmas and anthers of a raspberry flower mature over several days, and repeated pollinator visits are required for maximum fruit set (McGregor 1976). The foraging behavior of bees is, therefore, important to ensure pollination.

The floral morphology of *R. idaeus* ensures that insect visitors with pubescent ventral surfaces can also bring about significant pollen transfer (Faegri and van der Pijl 1971). Thus, other common floral visitors such as *T. affinis,* several cerambycids, and number of syrphid species may also be responsible for *R. idaeus* pollination.

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